Peter M. Brown,[1] Rocky Mountain Tree-Ring Research, Inc., 2901 Moore Lane, Ft. Collins, Colorado 80526

and

William T. Baxter, California Department of Forestry and Fire Protection 802 N. Main Street, Ft. Bragg, California 95437

Fire History in Coast Redwood Forests of the Mendocino Coast, California

Abstract

We reconstructed fire history in old-growth coast redwood stands along an ocean-to-inland gradient in Jackson Demonstration State Forest on the Mendocino Coast in northern California. Fire history was reconstructed for the past two to four centuries using fire scars recorded in tree rings. Surface fires were frequent disturbances in all stands prior to the early twentieth century. Composite mean fire-free intervals aggregated within stands varied from 6 to 20 yr, and point mean fire-free intervals averaged within trees varied from 9 to 20 yr. Fires ceased in the early 20th century coincident with the advent of organized fire suppression efforts beginning in the 1930s. Fire frequency did not vary significantly along the ocean-inland gradient. Although several of the inland stands tended to record shorter intervals between fires, there was high variability among sites. These and analogous fire-scar data from other studies across the range of coast redwood forests suggest that fire frequencies have been underestimated in some past assessments. A principal reason is that fire-scar records on coast redwood trees are difficult to locate because of inadequate preservation compared to other species that experienced surface fires. Cessation of surface fires has resulted in shifts in fuel and forest structure over recent decades, and the fire history reconstructed by this study provides both guidelines and justification for ecological restoration efforts in coast redwood forests of this region.

Introduction

Fire has long been recognized as an important disturbance in coast redwood (*Sequoia sempervirens*) forests (Fritz 1931), but the exact nature of historical fire regimes in many areas is uncertain. Coast redwood grows in relatively mesic, often fog-shrouded coastal locations not usually associated with widespread or frequent fires. Past studies and reviews of coast redwood fire ecology have concluded that, over much of its range, fires were typically infrequent and that effects on forest composition and structure varied depending primarily on fire severity (Veirs 1980, 1982, 1996; Wright and Bailey 1982; Agee 1993; Sawyer et al. 2000a). However, a growing body of evidence documents that frequent, episodic surface fires were the dominant fire regime in many coast redwood forests, and that loss of surface fires has occurred over the recent century in response to loss of Native American ignition sources, active fire suppression, and other changes in land use (Finney 1990; Finney and Martin 1989, 1992; Brown and Swetnam 1994; Brown et al. 1999).

Differences seen in fire regimes reconstructed by various studies are likely related both to site conditions that vary along ocean-to-inland gradients and with latitude (Veirs 1982, Stuart 1987, Agee 1993, Sawyer et al. 2000a) and to the differing methods used to reconstruct fire histories (Finney and Martin 1989, Brown and Swetnam 1994). Fire histories based mainly on aging of coast redwood or substory canopy trees have typically found that fires were infrequent and relatively severe, with recurrence intervals of ca. 20 to > 500 yr (Veirs 1980, 1982, 1996; Stuart 1987). Other studies examined fire scars to reconstruct relatively long intervals recorded on individual trees, with ranges from ca. 20 to > 50 yr between mixed-severity fires (Fritz 1931, Jacobs et al. 1985, Stuart 1987). Other fire-scar studies used data composited from several trees to reconstruct high surface fire frequencies in some areas, with mean recurrence intervals from 7 to 15 yr depending on site conditions and period analyzed (Finney 1990; Finney and Martin 1989, 1992; Brown and Swetnam 1994; Brown et al. 1999).

Defining the historical nature of fire has important implications for understanding ecological dynamics and guiding sustainable management in coast redwood forests (Jacobs et al. 1985,

[1]Author to whom correspondence should be addressed. E-mail: pmb@rmtrr.org

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